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(11)(21) 2 125 094

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(22) Date de dépôt/Filing Date: 1994/06/03

(41) Mise à la disp. pub./Open to Public Insp.: 1994/12/12

(45) Date de délivrance/Issue Date: 2005/08/30

(30) Priorité/Priority: 1993/06/11 (01 754/93-7) CH

(51) Cl.Int.^{7}/Int.Cl.^{7} B42C 9/00

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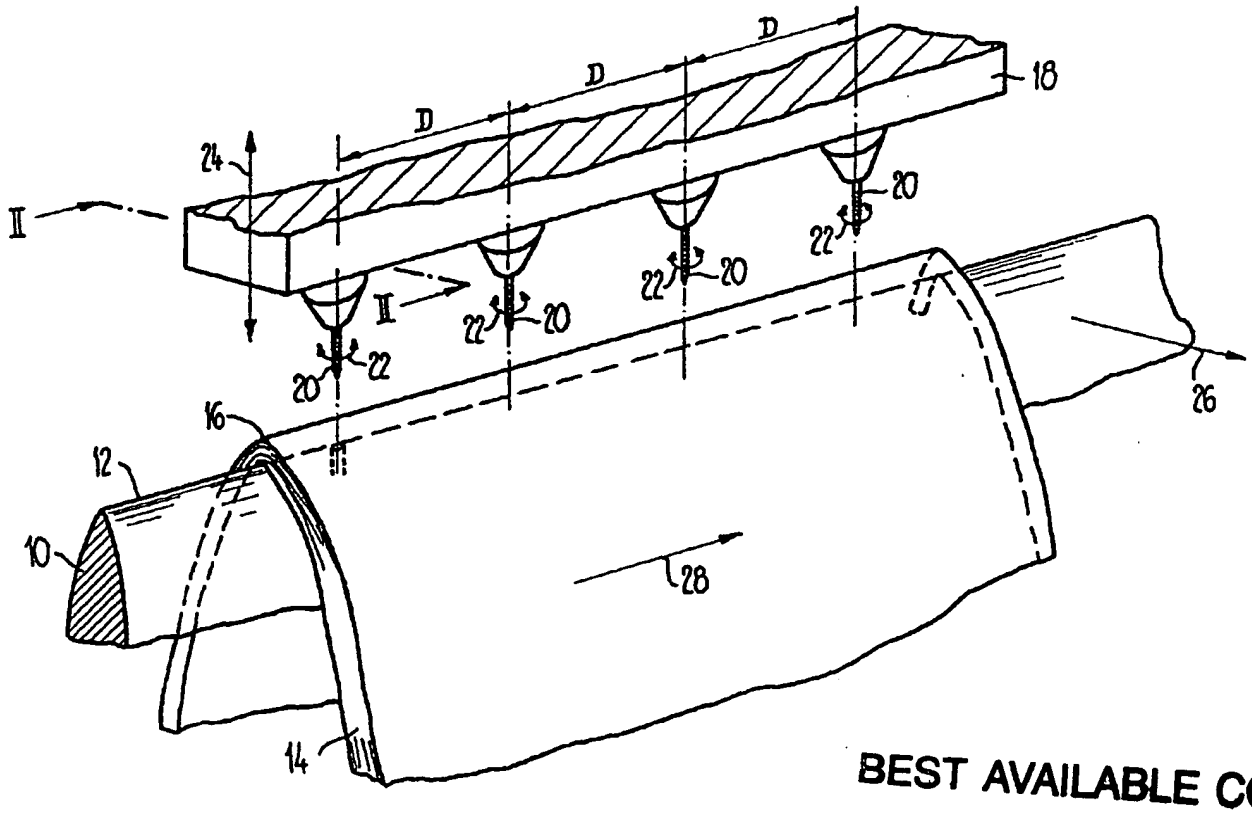
(54) Titre : METHODE ET INSTALLATION POUR RELIER LES FEUILLES D'UN IMPRIME A FEUILLES MULTIPLES
(54) Title: METHOD AND APPARATUS FOR CONNECTING THE SHEETS OF A MULTI-SHEET PRINTED PRODUCT



(57) Abrégé/Abstract:
For the connection of the sheets of a multi-sheet printed product (14), such as magazines, brochures and the like, the sheets are adhesively connected together point-wise by the introduction of an adhesive into perforations formed in them. During this, the adhesive applied to the outer side of the penetration and drilling needles (20) is transferred onto the sheets over the whole length of the perforations simultaneously with the formation of the perforations by means of these needles (20) and/or on retraction of the needles (20).

ABSTRACT OF DISCLOSURE

For the connection of the sheets of a multi-sheet printed product (14), such as magazines, brochures and the like, the sheets are adhesively connected together point-wise by the introduction of an adhesive into perforations formed in them. During this, the adhesive applied to the outer side of the penetration and drilling needles (20) is transferred onto the sheets over the whole length of the perforations simultaneously with the formation of the perforations by means of these needles (20) and/or on retraction of the needles (20).

TITLE OF THE INVENTION

"Method and apparatus for connecting the sheets of a multi-sheet printed product"

FIELD OF THE INVENTION

The present invention relates to a method for connecting the sheets of a multi-sheet printed product, such as magazines, brochures and the like, in which the sheets are adhesively connected together point-wise by the introduction of an adhesive into perforations formed in them, and also to an apparatus for carrying out this method.

BACKGROUND OF THE INVENTION

A method or an apparatus of the kind named above is known from EP-A-0390734.

In this known method, as also in the present method, the aim is to glue together the sheets or pages of magazines, brochures, pocket books and the like point-wise in the region of the spine instead of keeping them together with staples. During this the advantages of the known wire or staple fastening is to remain, such as for example the possibility of being able to fully open the product without a notable loss of the area available for printing adjacent the folded edge, i.e. a marginal region along which the sheets are inseparably connected together is to be avoided. A marginal region of this kind exists, for example, with the adhesive method of DE-A-2126495 which likewise belongs to the prior art, in which one first produces holes in the marginal regions of the sheets and then

fills these with a curable adhesive, so that a type of riveted connection with enlarged head and foot ends arises between the individual sheets.

In the prior art in accordance with EP-A-0390734, which likewise originates from the present applicants, the point-wise adhesive connection takes place at a row of adhesive positions which are arranged along a line which later forms the fold line of the respective product. The injection of the bonding agent takes place in this known prior art either after a pre-perforation of the paper layers and the application of the bonding means by hollow needles or canulas, or by direct droplet injection into the paper layers.

In an embodiment which is shown in Fig. 3 of EP-A-0390734 the perforation and the injection of the bonding medium can be executed in the same working step depending on the nature of the paper layers. This is possible when the bonding medium injection can be effected directly during the perforation by hollow needles or canulas. Although this procedure has its justification in practice, there are sometimes problems which one would prefer to avoid.

One problem lies in the fact that the hollow needles can become blocked at the hollow working tips, and indeed by small particles of paper which are punched out from the paper during penetration by the hollow needles. The hollow needles can also be relatively easily blocked by adhesive residues, since the central passage must be made relatively long in relation to its cross-section. The danger also exists that adhesive pushed out of the hollow needles does not penetrate into the individual paper sheets to an adequate degree

during the further movement of the hollow needles, i.e. does not adequately wet the paper sheets, so that the adhesive connection cannot always be ensured for a broad spectrum of different paper thicknesses and qualities or types. The higher the working speed, the more critical is the problem. The hollow needles are also exposed to a relatively pronounced wear when one takes account of the number of perforations which are to be executed at high working speed.

Finally, the use of the hollow needles leads to the holes which are formed being relatively large,particularly when the dangers of blocking and wear are to be reduced and this is undesirable since the puncture locations should remain inconspicuous in the finished magazine.

PRINCIPAL OBJECT OF THE INVENTION

The object of the present invention is to propose a method or an apparatus of the initially named kind which admittedly operates with needles or the like as penetration tools, but which nevertheless also ensures a reliable adhesive bonding between the individual sheets without the problems of blockage arising, and indeed at a high working speed with an increased working life of the tool, i.e. with reduction of the susceptibility to wear and for relatively small dimensions of the perforations that are produced.

SUMMARY OF THE INVENTION

In order to satisfy this object, the present invention proposes, in a method of the orginally named kind, that the adhesive is located on the outer side of a

perforation tool and is simultaneously transferred onto the sheets over the whole length of the perforations by means of the perforation tool during at least one of the penetration and extraction movements of the perforation tool relative to the sheets.

Also in accordance with the present invention there is provided an apparatus for connecting the sheets of a multi-sheet printed product, such as magazines, brochures or the like, wherein the sheets, which are supported on a support, are perforated by means of perforating tools and adhesive is introduced into the so formed perforations, wherein the penetration tool has a plurality of needles, each having a closed tip, with pick-up means, which receive the adhesive being provided at their outer side for transfer of the adhesive to the walls of the perforations.

Since the adhesive is located at the outside of the perforation tool, it is brought by the driving-in or extraction movement of this tool into intimate contact with the inner surface of the perforation which is simultaneously formed in one working step, so that a complete and uniform wetting of the sheets of stacked paper with adhesive is achieved. Since the perforation tool is pointed at its tip, the perforations are generated by lateral displacement of the paper material of the sheets, so that punched out paper particles no longer arise, and can thus also not lead to blockages. The pointed tapering ends of the tools also lead to reduced wear of the latter, so that they last longer. Since the adhesive is present on the tools at the outside, it serves, so to say, as a type of lubricant, so that the wear is also reduced for this reason. One also succeeds in making the passages or perforations

smaller than is possible with hollow needles, i.e. the adhesive connection remains absolutely inconspicuous. Since the displaced paper material has the tendency to return after removal of the tools, the diameter of the passages is finally also smaller than the outer diameter of the penetration tools.

In the method of the invention it is possible, as in the prior art of EP-A-0390734, to execute the adhesive bonding through a stack of sheets which is subsequently supplemented by the cover sheet and by the central sheet and only then fully folded together. In this way, no perforations can be seen in the cover sheet and in the central sheet and the previously introduced adhesive is sufficient, in particular as a result of the squeeze action associated with folding in order to also adhesively bond the cover sheet and the central sheet with the perforated sheets in the fold.

Since the penetration and the introduction of the adhesive takes place during one and the same to and fro movement of the penetration tool relative to the stack of sheets, the working time is kept short, so that the throughput achievable with the invention can be kept high.

The nature of the bonding of the sheets in accordance with the invention makes it possible to separate part of the sheets without the printed product falling apart.

The transfer of the adhesive onto the sheets preferably takes place during a screwing-in or screwing-out movement of penetration tools formed in needle-like manner. Although a pure linear movement of the tool

could be sufficient to generate the passages or the perforations, a rotational movement of the tools is consciously used in a preferred embodiment, at least during the driving-in or extraction of the latter. In this way the adhesive is scraped off from the tools and is brought into intimate contact with the paper sheets around the perforations, so that a high quality adhesive bond arises. The perforations are thus preferably generated with rotatable penetration or drilling needles.

For the further improvement of the transfer of the adhesive, this transfer takes place through a screw thread-like shape of the penetration or drilling needles.

One can proceed in this case in such a way that the driving-in speed or extraction speed and the speed of rotation of the penetration or drilling needles is selected so that it is matched to the screw thread pitch, with the thread shape of the needles generating a corresponding thread-like deformation of the paper material with an enlarged surface in comparison to a smooth cylindrical surface of comparable diameter, which serves to improve the quality of the adhesive bond.

Possibility however also exists of selecting the driving-in speed or speed of extraction and the speed of rotation of the penetration or drilling needles independently of the thread pitch, i.e. not matched to the latter. This leads, on the one hand, to a certain scraping action between the needles and the paper, and, on the other hand, to a certain jamming effect which presses the adhesive deeper into the paper material.

This design thus also leads to higher quality adhesive connections.

The possibility furthermore exists of selecting the driving-in speed differently from the extraction speed. In this, one has, for example, the possibility of executing the movement which is principally responsible for the adhesive transfer somewhat more slowly, and in exchange of executing the other phase of the movement somewhat faster, so that for comparable cycle times higher quality connections can also be generated here.

The possibility also exists of varying the rotational speed during the driving-in and/or the extraction of the tools. In this way one can attempt to obtain certain fine matching and an intentional distribution of the adhesive, for example in such a way that more adhesive is present in the region of the upper and lower sheets of the stack, which is useful for the subsequent connection of the covering sheet and of the central sheet respectively.

Whereas, in a preferred embodiment, the adhesive is applied to the penetration or drilling needles directly prior to the driving-in of the latter, the possibility also exists of fist applying the adhesive to the penetrating or drilling needles when these have penetrated the stack of sheets.

Further preferred embodiments of the method can be found from the further dependent claims. In the same way, preferred embodiments of the apparatus, and in particular shapes of the individual tools can be found from the dependent apparatus claims.

BRIEF LISTING OF THE FIGURES

The invention will now be explained in more detail with reference to the drawing and with reference to embodiments. In the drawing are shown:

Fig. 1 — a perspective illustration of a procedure for the connection, in the area of the fold line, of the sheets of a magazine which are laid on top of one another,

Figs. 2A to 2D — sectional drawings of the section plane II-II in Fig. 1 showing various stages of the manufacture of a connection between the sheets,

Figs. 3A to 3D — sectional drawings similar to the sectional drawings of Figs. 2A - 2D, but of a modified embodiment,

Figs. 4A to 4D — side views of four different embodiments of the penetration needles,

Fig. 5 — a detailed drawing of a penetration needle during the manufacture of an adhesive bond between several sheets laid on top of one another,

Fig. 6 — a schematic illustration of the adhesive bond between several sheets laid on top of one another after the extraction of the penetration needles, and

Figs. 7A, B, C, D, E and F sketches of various variants of an embodiment for the execution of the adhesive connection between a plurality of sheets laid on top of one another.

DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 1 shows an elongate support or transport element 10 with a support edge 12 and several prefolded paper sheets 14 which are laid on top of one another and which are so disposed over the support element 10 that their fold line 16 lies on the edge 12. A carrier beam 18 is located above the support or transport element 10 and carries several penetration tools in the form of penetration or drive-in needles 20 arranged with a mutual spacing D.

The penetration needles 20 are rotatably arranged and can be rotated in both directions of rotation as is indicated by the double arrow 22. The rotational drive is in practice arranged within the carrier beam 18 which is formed as a hollow beam. The carrier beam 18 can be moved downwardly in accordance with the double arrow 24 in order to press the penetration needles 20 through the sheets lying on top of one another and can be raised again in order to extract the penetration needles from the paper sheets.

As is indicated by the arrow 26, the transport element 10 can move past the carrier beam 18 and can stop in the position shown in Figure 1 for the driving-in and the extraction of the penetration needles. As alternative to this the carrier beam 18 can likewise be

moved in the arrow direction 26 with the same speed as the transport member 10 and can, for example, be subsequently set back again in order to drive the penetration needles 20 through a following sheet stack 14 on a further transport beam 10.

It is furthermore possible to displace the individual sheet stacks stepwise in the direction of the arrow 28 along the support element 10, so that for each step a new sheet stack is aligned, as shown in Figure 1, beneath the carrier beam 18 and can be processed by the penetration needles 20 by lowering of the carrier beam 18 and subsequent lifting of the carrier beam 18. It should be pointed out that the number of the penetration needles 20 is not restricted to four, but rather the number of the penetration needles can be selected as desired.

The precise drive-in process will be explained in the following in more detail with reference to Figures 2A to D, with these sectional drawings showing, on the one hand the formation of the support or transport element 10, and on the other hand, two further components, and indeed a press means 30, which functions as a product pressing means and cente ring means and which can be executed in accordance with the carrying beam 18 as an elongate beam, and also an adhesive supply means 32 which can be moved to and fro in accordance with the double arrow 34.

As can be seen from Figure 2A a bore 36 with a diameter which is somewhat larger than the diameter of the respective penetration needle 20 and which merges into a larger bore 38 is located directly beneath each needle 20 in the region of the support edge 12 of the

support element 10. The longitudinal axis of the needle 20 is aligned with the longitudinal axis 40 of the bore 36 and of the bore 38 coaxial hereto.

In the stage of Figure 2A the holding beam 18 is moved downwardly in accordance with the arrow 24 and the adhesive supply means 32 is located in its left hand end position in which the adhesive is dispensed in a metered quantity from a nozzle 42 onto the penetration needle 20 rotating in accordance with the arrow 22. An adequate length of the penetration needle 20 is coated with adhesive in order to transfer the adhesive in an adequate amount to the individual sheets of the stack during the pushing of the penetration needle 20 through the sheet stack 14. After the dispensing of the adhesive onto the penetration needle 20 the adhesive supply means 32 is removed to the right out of the region of the beam 18, so that it adopts the other end position in accordance with Figure 2B. The pressing means 30 is pressed towards the edge 12 of the support or transport element 10 onto the sheet stack 14. The carrier beam 18 is subsequently moved downwardly in accordance with the arrow 24 with simultaneous rotation of the penetration needles 20 in the arrow direction 22, so that the penetration needles 20 penetrate through the sheet stack and are partly received in the bores 36 and 38. The direction of rotation of the penetration needles 20 is then reversed, as shown in Figure 2C and the carrier beam 18 is lifted, so that the penetration needle 20 is drawn out of the sheet stack 14. The press means 30 remain down during this process and continues to exert pressure on the sheet stack, so that the upper sheets are not torn during the retraction of the needles 20.

The adhesive supply means 32 is subsequently moved after complete extraction of the needles from the right-hand waiting position in Figures 2B and 2C to the left into the position of Figure 2D, whereby the initial position of Figure 2A is achieved again. A following support element 10 with a new sheet stack 14 is then brought into alignment with the carrier beam 18, or a new sheet stack 14 is displaced along the support element 10 until this next stack is aligned with the carrier beam 18. The working cycle can then be repeated.

In this embodiment of Figures 1 and 2 the adhesive is introduced with the penetration needles 20 from the same side as the needles 20 are driven in. The needles 20 are so shaped, or the retraction of the needles takes place in such a way, that on retraction of the needles 20 the latter do not cause the adhesive to move out of the perforations formed by the penetration procedure to any notable degree. This is ensured, on the one hand, by the combined rotation and linear displacement possibilities during the driving-in and extraction of the penetration needles, as will subsequently be explained in more detail with reference to Figures 4, 5, 6 and 7.

Another variant consists in that the perforations are first formed by driving in of the penetration needles 20 and the adhesive is then applied to the needles 20 and transferred onto the paper sheets on retraction of the needles 20 through the previously produced through-openings. In this case the adhesive supply takes place at the inner side of the fold line 16, as is shown in Figures 3A to 3D.

In these Figures a different shape of the support 10 is first provided to support the sheet stack 14. In this case the support 10 has a planar support surface 44, on the lower side of which there are provided channel or individual chambers 46 which serve as a reservoir for adhesive 48 and are connected to a supply hose 50. Beneath each needle 20 there is also located a bore 36 which makes it possible to drive the needles 20 in accordance with Figure 3B through the sheet stack 14 and the bore 36 into the quantity of adhesive 48, so that the lower end of the penetration needle 20 is coated with adhesive which is transferred onto the individual sheets of the sheet stack 14 during the extraction movement.

The design of the carrier beam 18 and also of the pressing means 30 in this example corresponds to the design of the same components in the embodiment of Figures 1 and 2, solely with the difference that in practice the layout of the pressing means 30 is matched to the flat position of the sheet stack 14. In Figure 3 the pressing means 30 is, however, shown for the sake of simplicity in precisely the same manner as in Figure 2. Chambers or channels filled with adhesive could however basically be provided in accordance with Figures 3A to 3D precisely inside of the support element 10 of the embodiments of Figures 1 and 2.

After the dipping of the tips of the penetration needles 20 into the adhesive in accordance with Figure 3B, the carrier beam 18 is retracted via the intermediate position of Figure 3C into the end position of Figure 3D, with the press means 30 being retracted into the position of Figure 3D as previously only after complete removal of the penetration needles

20 from the sheet stack 14. Here the press means 30 also serves, on the one hand, for the centering of the penetration needles 20, and, on the other hand, in order to compress the sheet stack 14 and to prevent the upper sheets being torn on extraction of the penetration needle 20. One can see from Figure 3D that a small passage 52 remains after the extraction of the penetration needle 20, as is also the case with the embodiment of Figures 1 and 2.

The arrow 22 of Figures 3A and 3C indicates that the penetration needles 20 are rotated in the clockwise sense during driving-in and counter-clockwise during extraction. It would however be entirely conceivable not to provide any rotation of the penetration needles 20 for example during the drive-in movement of Figure 3, i.e. to set the rotary speed equal to zero.

In contrast to the embodiments shown in Figures 1 to 3, the penetration needles 20 could be arranged in the support element 10 in place of in the carrier beam 18. This would signify that the driving-in movement would take place from the bottom upwardly or from the inner side of the sheet stack 14 towards its outer side. During this, the supply of the adhesive can take place either as shown in Figures 1 and 2 at the outwardly disposed side or, as shown in Figure 3, at the inwardly disposed side of the sheet stack 14.

The Figures 4A to D now show various forms of the penetration needles 20 which can also have a drilling function and in some embodiments are thus also formed as drilling needles.

The penetration needle 20 of Figure 4A is provided with

a thread-like groove 21 and the individual turns of the thread can be somewhat undercut in order to form larger pockets for the reception of the adhesive. This type of the needle design is shown in the embodiment of Figures 2A to D and Figures 3A to D. As a result of the rotation of the penetration needles 20 in the clockwise sense during the penetration movement, in accordance with Figure 2A, the thread-like formation causes the needles 20 to pull themselves through the sheet stack 14 in the manner of a thread cutter. During this the adhesive which is located in the grooves will be scraped off as a result of the relative sliding between the surface of the needles 20 and the walls of the so formed passages in the sheet stack at the latter and will be pressed or massaged between the individual sheets. This pressing-in of the adhesive is also continued during the extraction of the needles with rotation in the opposite direction in accordance with Figure 2C.

In the embodiment of Figures 3A to D the adhesive is merely transferred onto the paper sheets in the same way and means on extraction of the needles during the rotation in the counter-clockwise sense in accordance with Figure 3C, i.e. the adhesive or glue is scraped from the grooves and turns of the needle 20 into the passages in the sheet stack 14. The front end 54 of the needles is in this embodiment, as in the other embodiments of pointed shape, so that the paper here is displaced more to the side by the needle 20 rather than drilled out. This has the advantage, that after the removal of the needles 20 the paper, provided with adhesive, moves back again, at least in part, so that the passages turn out smaller than the outer diameter of the needles 20.

In accordance with Figure 4B the needles 20 are provided with a type of twist screw thread 21a in similar manner to a drill, i.e. with a greater pitch. This type of tool is also suitable for use in the method of Figures 2 and 3 respectively. This also applies for the embodiment in accordance with Figure 4C where the needles 20 have a direct screw thread 21b and where the tip 54 is not only pointed, as in all other embodiments, but rather is also formed in the manner of a chipboard screw in order to achieve the broadening of the passage in the sheet stack 14 to the core diameter of the screw without generating large quantities of drilling flour. This embodiment is shown to a larger scale in Figure 5, and indeed here when used in an embodiment in accordance with Figure 3. One recognises that the material flow, i.e. the flow of adhesive from the screw onto the bore of the sheet stack 14 is ideal. During the through driving of the needles 20 no material dust arises and the sheet material is displaced without pronounced chip forming arising.

In accordance with Figure 4D the needles 20 are provided with a type of cutting screw thread 21C. This embodiment can also be used in the method of Figures 2 and 3 respectively.

In all variants the possibility exists of selecting the rotational speeds and the speed of advance, i.e. the drive-in speed or the extraction speed of the needles, so that it is matched to the thread pitch, whereby the corresponding thread shape is generated in the sheet stack 14 and the scraping action during the transfer of the adhesive onto the sheet stack is large. The possibility however also would exist of selecting the

speed of advance, i.e. the drive-in speed or the speed of extraction differently, so that no clean thread is cut in the sheet stack 14, with the slippage which then arises and a certain stagnation effect also leading to a favourable transfer of the adhesive to the sheet stack. In this way a type of drilling dust can arise which leads, in admixture with the adhesive, to a high quality connection between the individual sheets of the sheet stack 14 after the removal of the penetration needles 20.

Figure 6 in which the finished adhesive bond is illustrated shows how the small passage 52 which remains after the removal of the penetration needles 20 is reduced in diameter relative to the diameter of the bore 36 and the support beam 10, the diameter of which is only fractionally larger than the diameter of the needles 20. One also sees that the adhesive is not only present as a thin film along the inner wall of the passage 52, but rather that the adhesive zone 55 is present with a certain radial depth. The material displaced sideways during the driving-in of the needles 52 has moved back into the passage 52, i.e. the originally larger passage has become smaller.

The Figures 7A to F finally show further embodiments of penetration needles which can be used. In accordance with Figure 7A the penetration needle 20 has in cross-section the shape of an equilateral triangle with longitudinal grooves 60 receiving adhesive in the respective side surfaces 62 of the triangle. In Figure 7B the drive-in needle 20 has a circular cross-section with three sector-like longitudinal grooves 60, with a core region 64 of the needles 20 being retained.

Figure 7C shows how, with the aid of the needles 20 of Fig. 7B, the sheet stack 14 is penetrated and the penetration needles are receiving in a corresponding receiving chamber 66 of the support 10. In accordance with Fig. 7D this receiving chamber 66 is solely replaced by a recess which accommodates the tip of the penetration needle. The arrangement can be so effected that after the perforation of the paper sheets the needle holder, or a displaceable sleeve 68 of the needle holder 18, is pressed further downwardly and hereby a controlled quantity of adhesive is pressed into the sheet stack.

In accordance with Figure 7E, the penetration needle 20 is knife-like, with a flat oval form in cross-section, and is also here provided with longitudinal grooves or channels 60, which serve to receive adhesive. Since the adhesive is provided in these grooves or channels 60, it is not so easily scraped off from the tool during the linear penetration movement of the penetration needles 20 (which here takes place without a superimposed rotary movement), but rather the displaced paper material is urged into the grooves 60 and an approximately uniform distribution of the adhesive onto the individual sheets of the paper stack 14 takes place.

Finally, Figure 7F shows how the holder 18 or the displacement sleeve 68 of the holder 18 can simultaneously effect the function of a pressing means 30, in order not to tear the paper sheets on extraction of the penetration needles 20.

The described adhesive bond takes place, as already mentioned, along a line which, as can be seen from

Figure 1, corresponds in prefolded sheets with their fold line 16, or along the line about which the finished end product, that is to say for example a magazine, a brochure or an issue is later folded with non-prefolded sheets.

The most diverse adhesives available in commerce can be used as an adhesive, such as for example cold glue. Adhesives can also be used which require a follow-up treatment, for example a thermal treatment after their introduction into the passages 52.

WHAT IS CLAIMED IS:

1. A method for connecting the sheets of a multi-sheet printed product, such as magazines, brochures and the like, in which the sheets are adhesively connected together point-wise by the introduction of an adhesive into perforations formed in them, wherein at least one recess is provided on an outer surface of a perforation tool, the adhesive is introduced from the exterior in the at least one recess on the outer side of the perforation tool and is simultaneously transferred onto the sheets over the whole length of the perforations by means of the rotatingly driven perforation tool during at least one of a penetration or an extraction movement of the perforation tool relative to the sheets.

2. A method in accordance with claim 1, wherein the transfer of the adhesive onto the sheets takes place during a screwing in movement of the perforation tool.

3. A method in accordance with claim 1, wherein the transfer of the adhesive onto the sheets takes place during a screwing out movement of the perforation tool.

4. A method in accordance with any one of the claims 1 to 3, wherein the perforations are generated with rotatable needles representing the perforation tool, with the needles being arranged either in at least one row on a common support beam or in a support for the sheets.

5. A method in accordance with claim 4, wherein the transfer of the adhesive is generated by a thread-like construction of the needles.

6. A method in accordance with claim 5, wherein at least one of the penetration speed or the extraction speed of the needles or the speed of rotation of the needles are matched to a pitch of said thread-like construction.

7. A method in accordance with claim 5, wherein at least one of the penetration speed or the extraction speed of the needles or the speed of rotation of the needles are selected so that they are different from a pitch of said thread-like construction.

8. A method in accordance with any one of the claims 1 to 5, wherein the penetration speed of said perforation tool is selected differently from the extraction speed thereof.

9. A method in accordance with claim 4 or 5, wherein a speed of rotation of the needles is selected differently during the penetration of the needles than a speed of rotation on extraction of the same.

10. A method in accordance with claim 9, wherein one of the said speeds of rotation is zero.

11. A method in accordance with claim 9, wherein at least one of said speeds of rotation is varied during penetration and extraction of said needles.

12. A method in accordance with any one of the claims 1 to 11, wherein the sheets are supported during the adhesive bonding procedure on a support which has at least one recess or opening arranged in accordance with the perforation tool to receive a tip of the perforation tool.

13. A method in accordance with any one of the claims 1 to 12, wherein the adhesive is directly applied to the perforation tool prior to said penetration movement.

14. A method in accordance with any one of the claims 1 to 12, wherein the adhesive is applied to the perforation tool after the penetration of the sheets prior to said extraction movement.

15. A method in accordance with any one of the claims 1 to 14, wherein the sheets which lie on top of one another are bonded together point-wise along a line which coincides with a folded edge of the finished product.

16. A method in accordance with any one of the claims 1 to 15, wherein the adhesive is subjected to a follow-up treatment after its introduction into the perforations.

17. A method in accordance with claim 16, wherein said follow-up treatment comprises a thermal treatment.

18. A method in accordance with any one of the claims 1 to 3, wherein said perforation tool comprises a plurality of penetration needles which penetrate said sheets and are extracted therefrom with a linear non-rotational movement.

19. An apparatus for connecting the sheets of a multi-sheet printed product, such as magazines, brochures or the like, wherein the sheets, which are supported on a support, are perforated by means of perforating tools and adhesive is introduced into the so formed perforations, the improvement wherein the perforating tools have a plurality of needles, each having a closed tip, with pick-up means which receive the adhesive being provided at the outer sides of the needles for transfer of the adhesive to walls of the perforations.

20. Apparatus in accordance with claim 19, wherein said pick-up means comprise at least one of channels or grooves.

21. Apparatus in accordance with claim 19 or 20, wherein a rotary drive is provided for the needles.

22. Apparatus in accordance with claim 21, wherein said rotary drive is reversible.

23. Apparatus in accordance with any one of the claims 19 to 22, wherein means is provided for advancing and retracting the penetration or drilling needles and wherein a pressing means is provided which presses against a stack of sheets during at least one of the penetration or extraction of the needles.

24. Apparatus in accordance with any one of the claims 19 to 23, wherein the support has one of recesses or openings arranged in accordance with spacings of penetration or drilling needles (20).

25. Apparatus in accordance with any one of the claims 19 to 24, wherein an adhesive supply means is located directly above the sheets in a penetration region of the needles.

26. Apparatus in accordance with claim 25, wherein an adhesive supply means is moveable into a penetration region of the needles.

27. Apparatus in accordance with any one of the claims 19 to 24, wherein an adhesive supply means is provided having a number of adhesive outlet nozzles corresponding to the number of the penetration or drilling needles.

28. Apparatus in accordance with claim 27, wherein said adhesive supply means is movable to and fro in a direction towards the needles and away from these.

29. Apparatus in accordance with claim 28, wherein a synchronising means is provided which synchronises the to and fro movement of the adhesive supply means with the movement of the needles, with the adhesive supply means being arranged directly adjacent the needles prior to driving them into a stack of sheets.

30. Apparatus in accordance with any one of the claims 19 to 24, wherein an adhesive supply means is arranged beneath the sheets which lie on top of one another.

31. Apparatus in accordance with claim 30, wherein said adhesive supply means comprises at least one hollow chamber in or beneath the support which supports the sheets.

32. Apparatus in accordance with any one of the claims 19 to 31, wherein the respective needles have a screw thread shape.

33. Apparatus in accordance with claim 32, wherein the screw thread shape of the penetration or drilling needles is one of a thread shape which forms an undercut adhesive pick-up pocket, a twist screw thread form, a direct screw thread form, or a cutting screw thread form.

34. Apparatus in accordance with claim 32 or 33, wherein the needles are executed as a self-cutting threaded screw.

35. Apparatus in accordance with any one of the claims 19 to 34, wherein the needles are formed as drilling needles and have a pointed end which displaces the sheet material sideways.

36. Apparatus in accordance with claim 19, wherein the needles are formed as penetration needles and have a cross-section substantially in the form of a substantially equilateral triangle, with longitudinal channels forming adhesive receiving pockets being formed in respective side surfaces.

37. Apparatus in accordance with claim 19, wherein the needles are formed as penetration needles and have a cross-section substantially of circular cross-section with a plurality of sector-like longitudinal grooves which serve as adhesive pick-up pockets.

38. Apparatus in accordance with claim 19, wherein the needles are formed as penetration needles and have an elongate, substantially knife-like, shallow oval shape in cross-section, with longitudinal grooves forming adhesive pick-up pockets being arranged distributed around the outer periphery of the needles.

39. Apparatus in accordance with claim 19, wherein each needle has a central bore which ends a distance from a tip end of the needles, but is however provided with at least one transverse bore which opens at a surface of the needle.

40. Apparatus in accordance with claim 19, wherein each needle has a central bore which ends a distance from a tip end of the needles, but is however provided with at least one transverse bore which opens into adhesive pockets formed in the needle.

41. Apparatus in accordance with claim 19, wherein each needle is guided in a respective guide; and wherein an adhesive supply passage is formed in the guide and first opens into adhesive pockets formed in the needle in an end region of the guide towards the tip of the respective needle.

42. Apparatus in accordance with claim 19, wherein the needles are arranged in at least one row on a common carrying beam.

43. Apparatus in accordance with claim 42, wherein said beam is moveable towards the support.

44. Apparatus in accordance with claim 19, wherein said needles are arranged in the support.

45. Apparatus in accordance with claim 44, wherein the support is movable.

46. Apparatus in accordance with claim 45, wherein said support rotates about an axis which extends parallel to its longitudinal axis, and the needles are co-movable with the support.

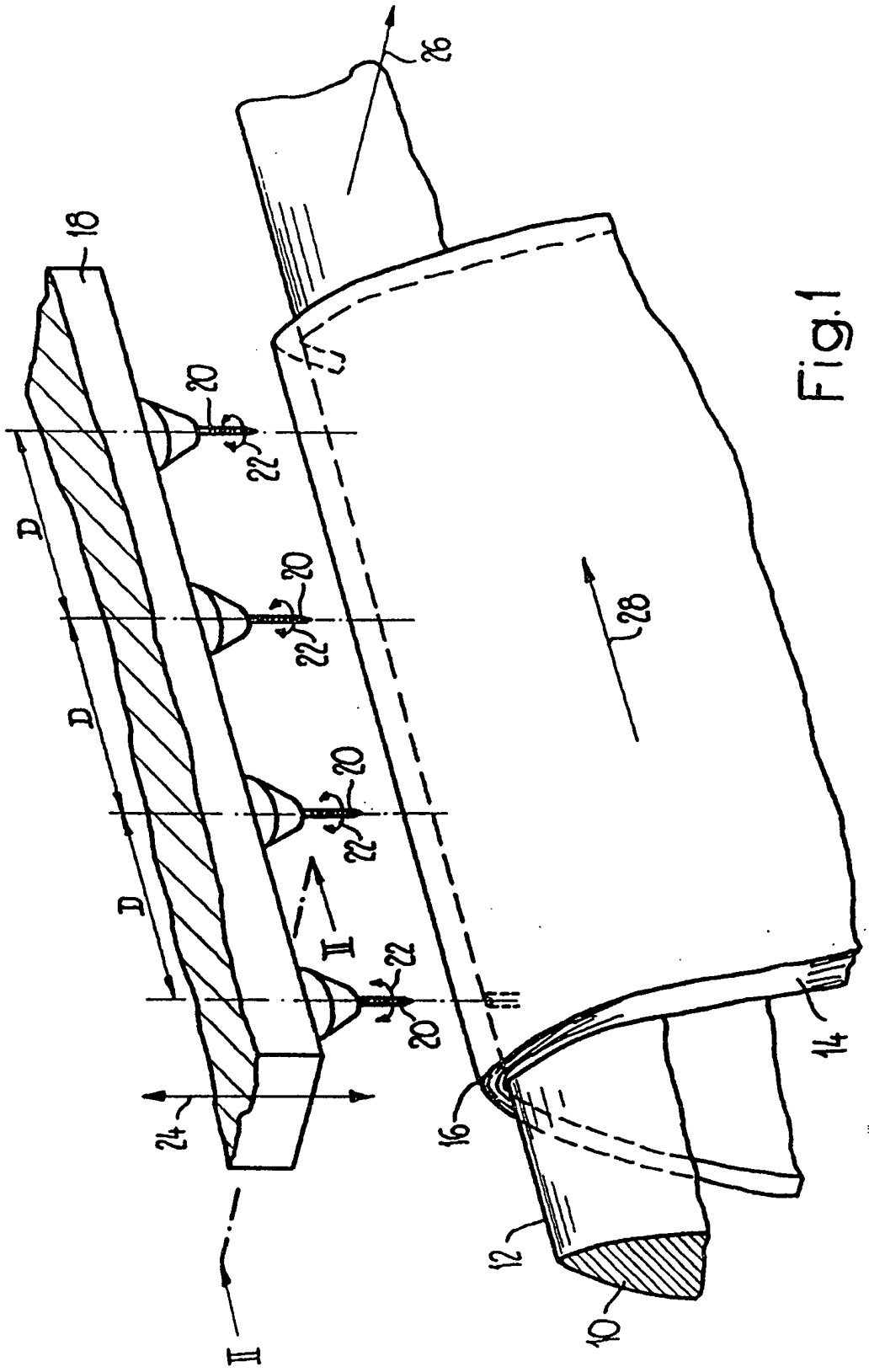


Fig.1

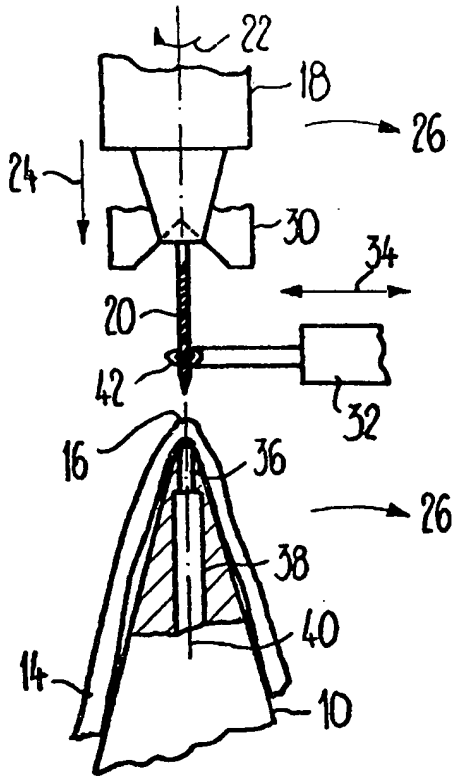


Fig.2A

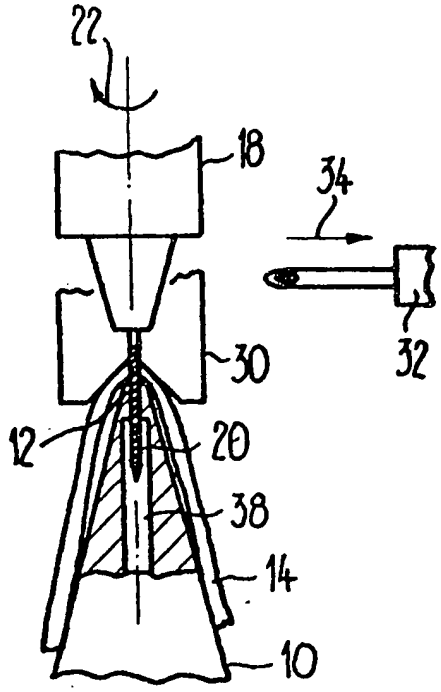


Fig.2B

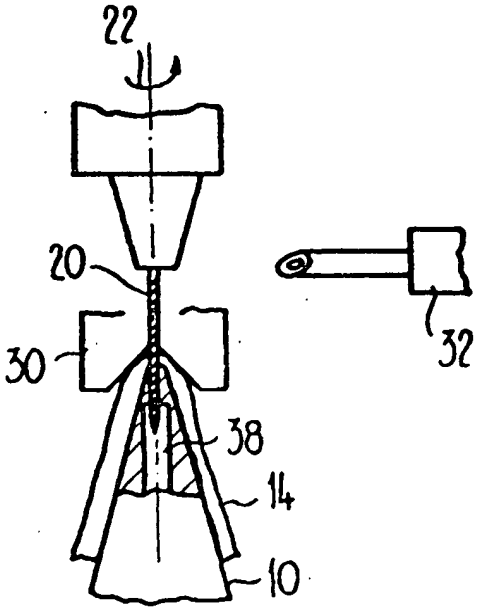


Fig.2C

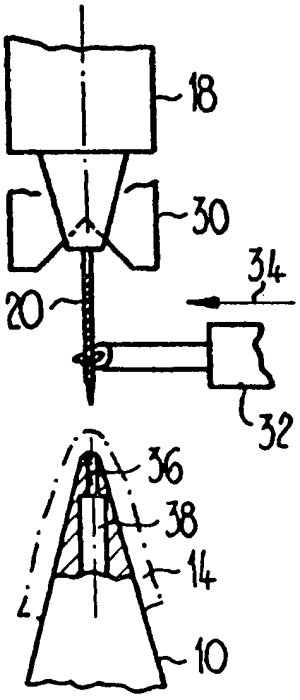


Fig.2D

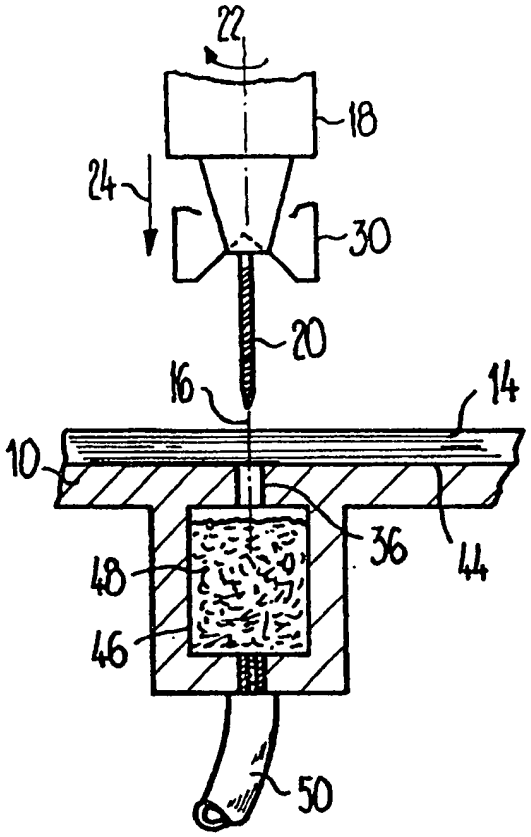


Fig.3A

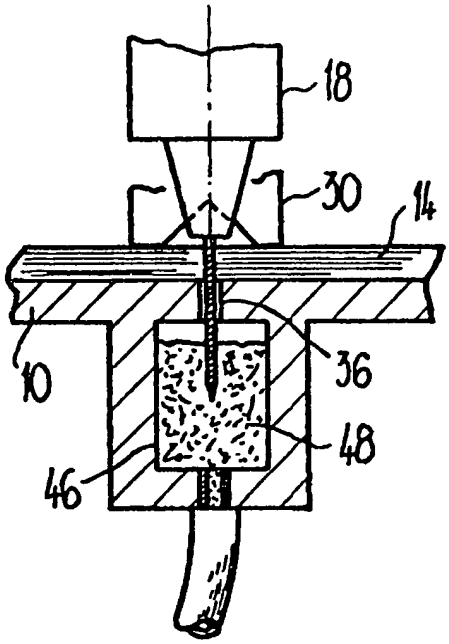


Fig.3B

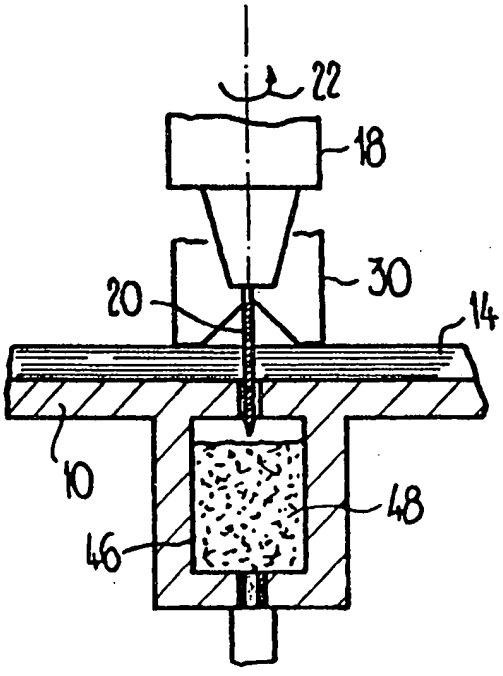


Fig.3C

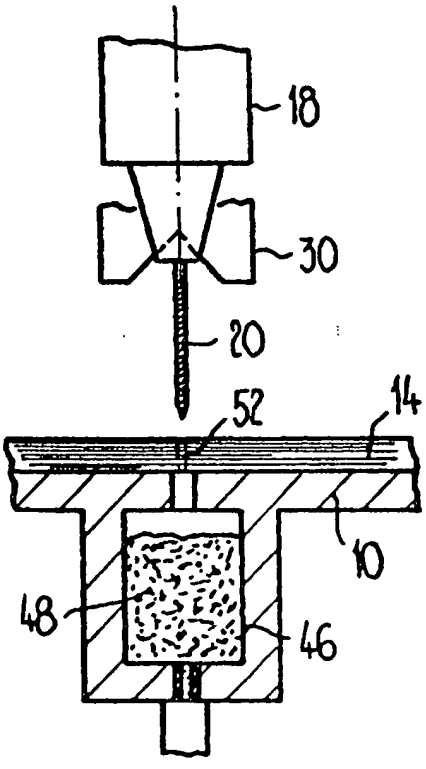


Fig.3D

Fig.4A

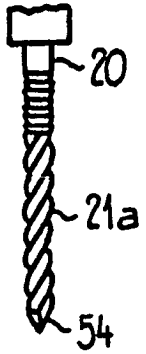


Fig.4B

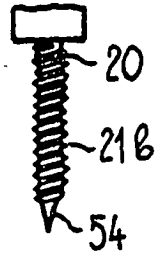


Fig.4C

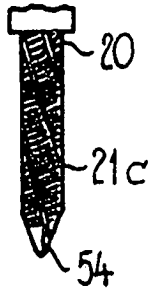


Fig.4D

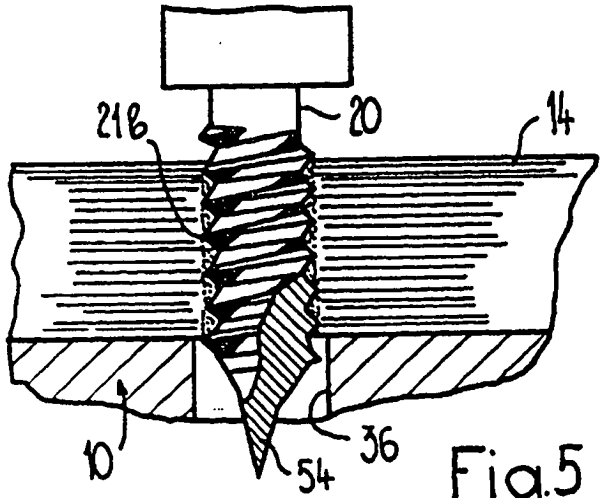


Fig.5

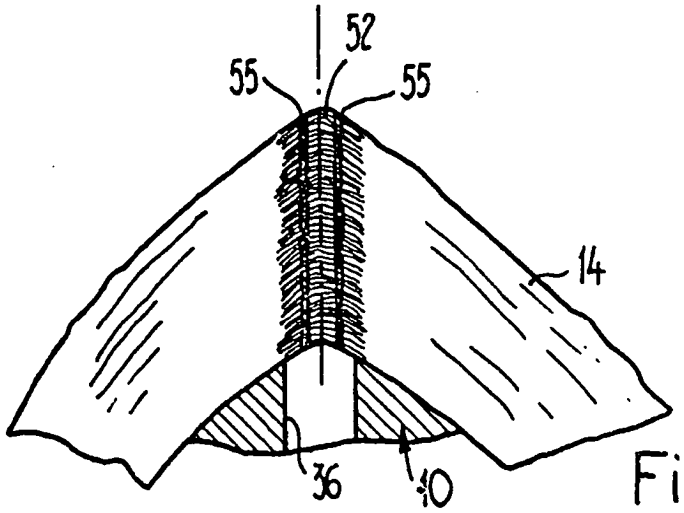


Fig.6

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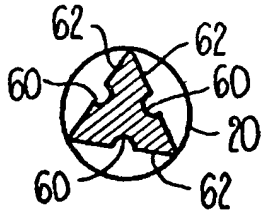


Fig.7A

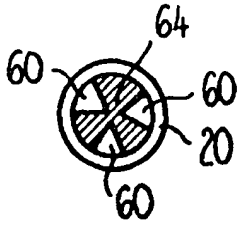


Fig. 7B

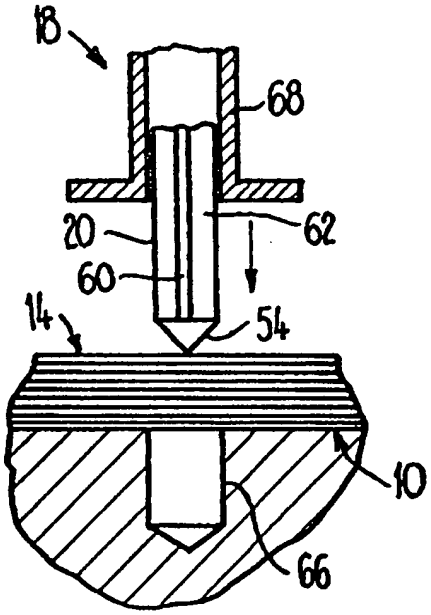


Fig.7C

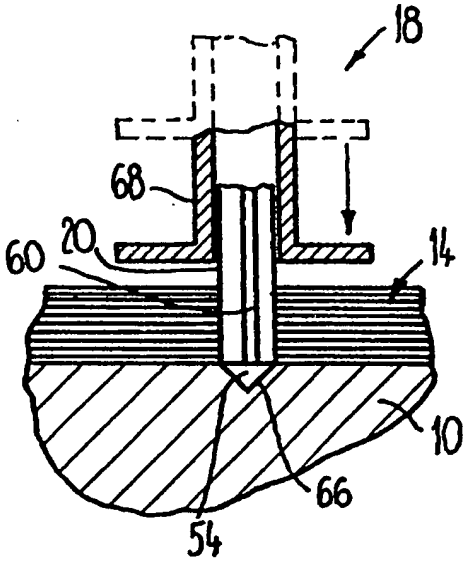


Fig.7D

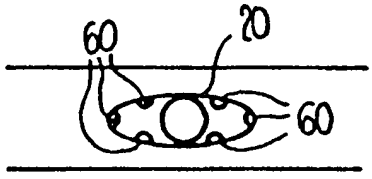


Fig.7E

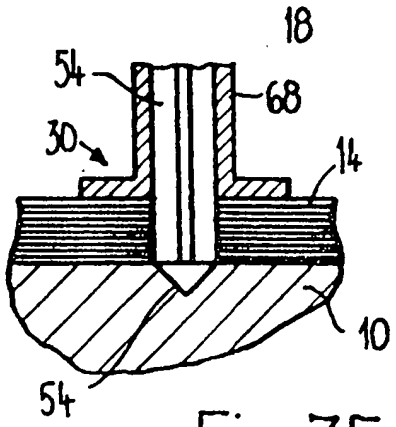
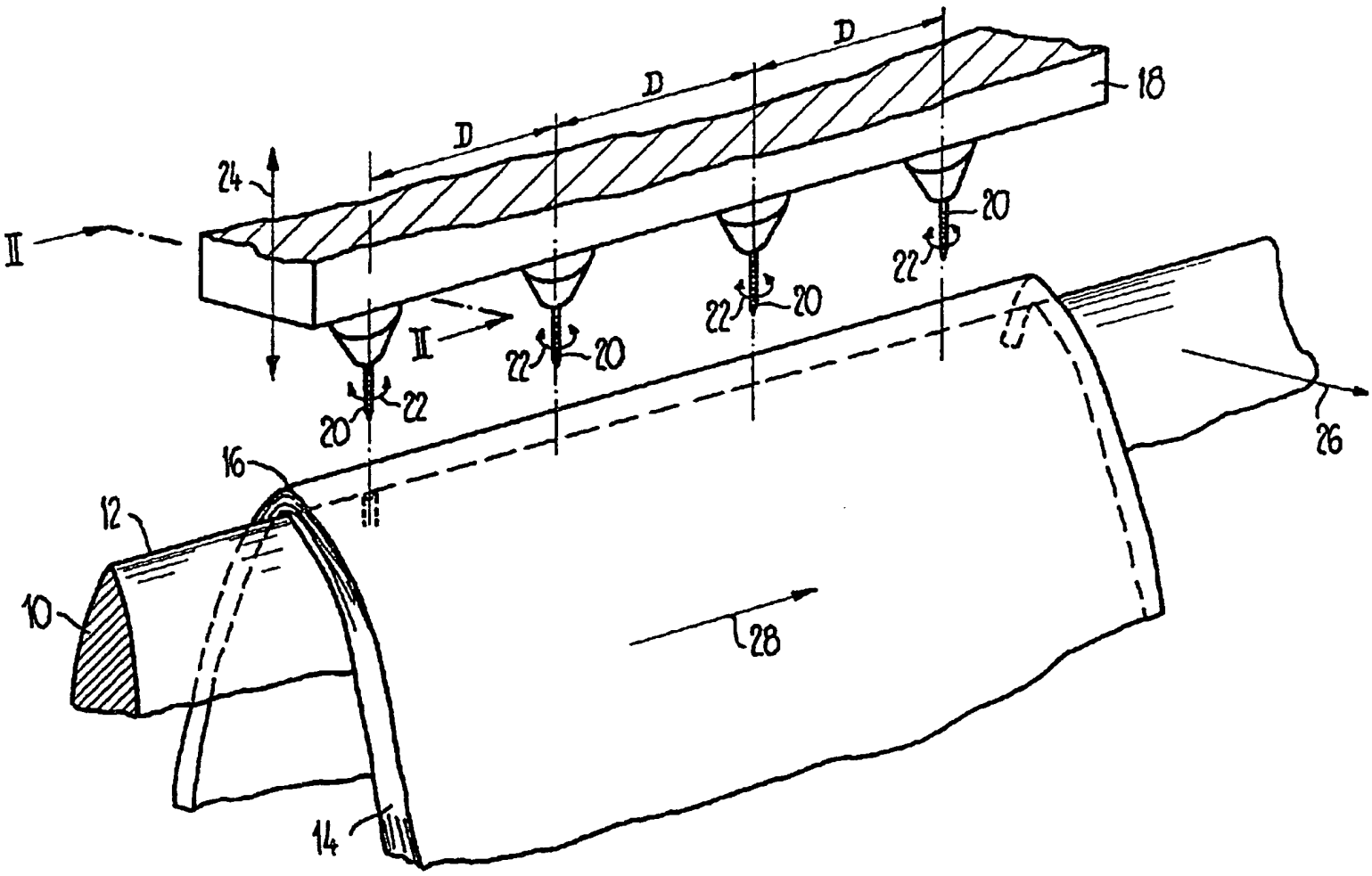


Fig.7F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